Marijuana Lobby Fact Check

Summary

Claims you heard yesterday from the marijuana lobby:

	Claim	TRUE?
1	All the testing has been done in animals.	NO
2	The DEA won't allow testing in humans	NO
3	CDPHE can't differentiate between active and inactive THC.	NO
4	"I'm speaking to you with a THC level above 5 ng and I'm not impaired."	Not proven
5	A DUID amendment isn't needed because 90% of DUID charges already result in a conviction.	NO
6	Daniel Rees has shown that drug *per se* laws don't work.	Partially true, but misleading
7	There's no science to support any limit.	NO

Discussion

Let's take care of the easy ones first:

1 All the testing has been done in animals

Drug safety testing always begins with animal testing. Animal testing has been used to study marijuana, showing such effects as dependence and brain abnormalities. But all impaired driving tests have been performed on humans. Only humans.

2 The DEA won't allow testing in humans.

There have been literally thousands of marijuana tests on humans, some referenced below.

3 The tests done by CDPHE can't differentiate between active and inactive THC.

CDPHE performs two types of tests on blood samples submitted to confirm DUID. The first is an ELISA test to screen for the presence of various families of drugs: alcohol, amphetamines, methadone, barbiturates, benzodiazepines, cannabinoids, opiates, phencyclidine, and propoxyphene. A positive cannabinoid result does not specify the type of THC. If the sample is positive for cannabinoid, then a confirmatory GC/MS test is performed to identify both the type and quantity of THC. This test is very specific for Δ^9THC, as well as other drugs.

4. "I'm speaking to you with a THC level above 5 ng and I'm not impaired."

No one testifying has provided evidence that their THC level is above 5 ng. Some, but not all, are confused by the difference between Δ^9THC and inactive THC-COOH.

Some testifying were obviously impaired, but whether that's from marijuana or not, we may never know. Others appear unimpaired. This is not surprising. Cannabis impairment manifests itself differently from alcohol impairment. See page 6 for a description of this.

Even doctors who self-medicate have deluded themselves into believing they are fully functional while impaired. And none of those testifying claimed to be doctors.

5 A DUID amendment isn't needed because 90% of DUID charges already result in a conviction.

This statement misrepresents the facts. State Judicial has stated that 85-90% of DUI charges result in convictions (depending on the year). But DUI isn't the same as DUID. Our current DUI law, C.R.S. 42-4-1301 (1), does not distinguish between alcohol-impaired driving (DUI) and drug-impaired driving (DUID). Therefore, Judicial data that are commonly cited for 85% - 90% conviction rates cannot distinguish between DUI and DUID. The vast majority (estimated at 92%) of DUI citations are for alcohol. A very high conviction rate for alcohol DUI is to be expected, since alcohol *per se* legislation supports DUI convictions. Since we have no comparable drug *per se* legislation, a similar conviction rate for DUID is not likely, and anecdotal evidence confirms this. But Judicial data simply cannot tell us what DUID conviction rates are.

Secondly, not all of the conviction rates reported by Judicial are DUI convictions. Some are convictions or plea bargains for lesser crimes.

An analysis of 40,000 Judicial records from July 1 to Dec 31, 2010, showed:
73% were found guilty of DUI and/or DUI *per se*
11% were found guilty of a lesser charge

6 Daniel Rees has shown that drug *per se* laws don't work.

Failing to find an impact is not the same as finding that there is no impact, especially with a study that lacks controls or sensitivity to isolate the impact of other factors. Traffic deaths declined by 25% from 2005-2010. There is no consensus as to why this occurred. This demonstrates how difficult it is to track the impact of a single policy during this time period.

NHTSA has acknowledged that there is little evidence that drug *per se* laws enacted by the states are effective in reducing drugged driving fatalities. NHTSA cites both the quality and variability of the various laws, as well as ineffective implementation of those laws.

For example, some states prohibit all scheduled drugs and their metabolites. Some prohibit drugs only in minors. Some prohibit only a small number of mind-impairing drugs. Some avoid including marijuana at all. Yet, to support their thesis, Rees and Anderson pooled data from all of these states together, something that is statistically indefensible.

As to NHTSA's comment on effective implementation of *per se* laws, we should understand that alcohol DUI enforcement is eased by the availability of on-site breath testing technology that is fast, cheap, and does not raise Fourth Amendment issues. No such technology is available for drugs. All peace officers are trained to identify alcohol impairment. Few are trained in the much more difficult task of identifying drug impairment. This is important, because drug impairment manifests itself much differently than alcohol impairment, and Standardized Field Sobriety Tests (SFST) have been proven[1] to be insensitive in detecting impairment in chronic marijuana users. Colorado has fewer than 200 active DREs who are trained to recognize drug impairment, compared with over 7,000 officers who are trained to recognize alcohol impairment.

Alcohol *per se* laws work. But it is not possible to sort out the effect of *per se* laws from the other factors that have caused drunk driving deaths to drop 48% between 1982 and 2009. Other contributing factors include better enforcement tools, education, changing social standards, and better car and highway design. In contrast, drugged driving is dealing with varied and frequently

[1] Bosker, W.M., Theunissen, E.L., Conen, S., Kuypers, K.P.C., Jeffery, W.K., Walls, H.C., Kauert, F.F., Tonnes, W.W., Moeller, M.R., Ramaekers, J.G.; "A placebo-controlled study to assess Standardized Field Sobriety Tests performance during alcohol and cannabis intoxication in heavy cannabis users and accuracy of point of collection testing devices for detecting THC in oral fluid"; Psychopharmacology, May 13, 2012, DOI 10.1007s00213-012-2732-y

weak drugged driving laws, poor enforcement tools, ineffective education, and social standards that are changing in favor of recreational drug use.

Rees completely ignored the success DOT has found in their drugged driving *per se* restrictions for commercial drivers that rely upon pre-employment, annual, and random urine tests.

The point is that drug *per se* laws alone cannot be expected to turn the tide of increasing drugged driving deaths. But they are likely a prerequisite, as indicated by success with alcohol *per se* laws and commercial driver *per se* regulations.

7 There's no science to support any limit.

- Hard science supports DUID *per se* laws, but it doesn't support a 5 ng/ml limit for THC in blood of drivers.
- There will never be scientific agreement on a number for THC that is equal to .08 BAC.
- There is a poor correlation between blood THC levels and impairment. But that is no reason not to act responsibly to ensure safe highways.

Those who claim that hard science doesn't support a defined level for THC or any other drug typically do so for one or more of the following reasons:

1 They are using outdated scientific information – this report provides the latest information, including 2013 publications.
2 Their expectations of science are unrealistic – science won't define a THC permissible limit, only politics will do that, just as politics established alcohol's permissible limits using scientific data.
3 These are comments from non-scientists, simply repeating the mantra of other non-scientists – if hard science were to be available, how would they know?

The reality is that hard science can assist political leaders in making the decisions they must make, but it cannot establish a permissible limit, above which everyone is impaired, and below which, no one is impaired. That's not because we need more studies. It's because of the natural biological variability of humans. And that variability is greater for drugs like THC than it is with alcohol for well-known scientific reasons.

The following summarizes four types of reports that deal with the question of establishing permissible limits for drugs while driving:

1. Epidemiological – the study of incidence in large populations
2. Experimental – controlled studies of cause and effect in small study groups
3. Empirical – data that fall short of the scientific rigor of epidemiological studies.
4. Expert panel review – results of expert study of the above focused on delivering guidance for policy making. Panel review may or may not reach consensus.

Epidemiological studies

The July 2011 study from by Mu-Chen Li[2], et.al is a meta-analysis of nine recent studies that were conducted and reported such that the odds ratio could be pooled. The authors concluded that," Pooled analysis based on the random-effects model yielded a summary odds ratio of 2.66 (95%confidence interval: 2.07, 3.41)." This means that drivers using marijuana are 2.66 times more likely to be involved in a crash than a driver not using marijuana. The only study that did not show a positive correlation between marijuana use and traffic crashes was a study in Thailand, but the numbers in the study were quite small because of the low prevalence of marijuana use in that country. The Li study is limited in that it based marijuana use primarily on self-reports and urine tests of carboxy-THC, which is itself a non-impairing metabolite of Δ^9THC.

[2] Li, M. et.al.; Marijuana Use and Motor Vehicle Crashes; *Epidemiological Reviews*, October 4, 2011

Asbridge[3] and colleagues reported a stronger meta-analysis in February, 2012. Asbridge selected studies based upon their overall quality, and most based marijuana use on blood studies of THC, making the data more meaningful. Asbridge sorted through 2,975 published studies, and nine met the criteria for inclusion in his meta-analysis. These studies covered 49,411 subjects. All but one of the studies used a 1 ng/ml cutoff level to determine marijuana use. The overall odds ratio was 1.92, but was higher in case controlled studies (2.79) and studies of fatalities (2.10).

A more recent review (September 2012) by Hartman[4] and Huestis shows a more complete review of epidemiological studies of all types. This study is particularly useful since it shows the variability in study results. The authors concluded that differences in study designs frequently account for the inconsistencies in studies. Nevertheless, the studies confirm that, "the risk of involvement in a motor vehicle accident (MVA) increases approximately 2-fold after cannabis smoking... evidence suggests recent smoking and/or blood THC concentrations 2–5 ng/mL are associated with substantial driving impairment, particularly in occasional smokers."

Experimental studies

Experimental studies are the most scientifically rigorous way of assessing marijuana's impact on driving skills. Because of their rigor, they can only be done on small, select study groups that may not represent the population at large. A variety of quantitative impairment assessment tools have been used to determine different aspects of the impairing effects of marijuana. This is material because marijuana impairment is nothing like alcohol impairment. Assessment tools that are useful to confirm impairment for alcohol are sometimes useless to confirm impairment with marijuana.[5] That doesn't mean the subject isn't impaired, it simply means that the assessment tool used is not designed to detect marijuana impairment.

The Hartman review noted above summarizes the results of a wide spectrum of experimental studies. The review is particularly helpful to understand the complexity of performing impairment studies. The studies point out quite clearly that, "Experimental data show that drivers attempt to compensate by driving more slowly after smoking cannabis, but control deteriorates with increasing task complexity. Cannabis smoking increases lane weaving and impaired cognitive function. Critical-tracking tests, reaction times, divided-attention tasks, and lane-position variability all show cannabis-induced impairment. Despite purported tolerance in frequent smokers, complex tasks still show impairment."

We will cite four studies here from two researchers. Both are European researchers, of very different background. Jan Ramaekers is an experimental psychopharmacology researcher at Maastricht University in The Netherlands. He has done frequent contract research for the National Institute of Drug Abuse in Washington DC. Franjo Grotenhermen works at Nova Institute and is the chairman of CAM (Cannabis as Medicine). Both have attempted to define an appropriate level to set for THC impairment in *per se* laws. Ramaekers is considered to be the more unbiased of the two. Grotenhermen's work is more frequently quoted by the marijuana lobby to make its points.

Why has trying to find a '.08 BAC equivalent' for THC has so far been the exclusive domain of Europe? Is it because their legal systems are different? Is it because they don't have to factor in 4th amendment delays to collect their blood specimens?

---

[3] Asbridge, M., et.al.; Acute Cannabis consumption and motor vehicle collision risk; *British Medical Journal*, BMJ2012;344:e536 doi: 10.1136/bmj.e536 (9 February, 2012

[4] Hartman, R.L., Huestis, M.A.; Cannabis Effects on Driving Skills; *Clinical Chemistry* 201:10.1373/clinchem.2012.194381

[5] Bosker, et.al.; A placebo-controlled study to assess Standardized Field Sobriety Tests performance during alcohol and cannabis intoxication in heavy cannabis users..; *Psychopharmacology*, DOI 10.1007/s00213-012-2732-y, April 2012

In 2006, Ramaekers[6] published "Cognition and motor control as a function of Δ^9THC concentration in serum and oral fluid: Limits of impairment," copy attached. He used three different assays, but did not include Divided Attention Task (DAT), which has since been shown to be impaired even with chronic users of cannabis who may show no impairment on some other assay tools. When reading European studies, it is especially important to distinguish between THC concentrations in plasma or serum, versus blood. Typically blood concentration is one-half that of a plasma or serum concentration. A few major points from this study:

1 Impairment as a function of THC concentration is non-linear,
2 Because of the non-linearity, it is most useful to show percentage of a population that is impaired at any given THC concentration:
   a. Impairment begins 2.5 ng/ml (serum)
   b. 75-90% impaired 5-10 ng (serum) [Note: this is 2.5-5 ng/ml in blood]
   c. 100% impaired 30 ng (serum)
3 The concentration of THC is not an accurate indicator of the magnitude of impairment. Nevertheless, studies confirm the following:
   - Odds ratio 1.45 if THC 1-2 ng/ml (blood)
   - Odds ratio 2.13 if THC 2-5 ng/ml (blood)
   - Odds ratio 2.1-6.6 if THC >5 ng/ml (blood)
4 "Serum THC concentrations between 2 and 5 ng/ml (blood concentrations between 1 and 2.5) establish the lower and upper range of a THC limit for impairment"
5 "Even at a 5 ng/ml limit (serum) only 70–90% of the observations were indicative of impairment, meaning that in 10–30% of the observations there was no impairment at all. The purpose of a per se limit is to indicate the average THC concentration above which drivers are at risk and should be interpreted as such."

Ramaekers' data were based on a study of 20 recreational cannabis smokers. He excluded novices who would be expected to be more readily impaired at lower doses, and he excluded daily users. He cautioned that his conclusions apply only to a population similar to his study cohort, which does not represent the full range of novices, recreational users and medicinal cannabis users in Colorado.

In 2010, Ramaekers[7] published "Tolerance and cross-tolerance to neurocognitive effects of THC and alcohol in heavy cannabis users," copy attached. This time he selected daily cannabis users, and include DAT as an assessment tool. A few major points from this study:

1 Heavy THC users develop tolerance to the impairing effects of THC on neurocognitive performance, but not cross tolerance to the impairing effects of alcohol.
2 THC did not affect Critical Tracking Task, Stop Signal and Tower of London tests in heavy users, but THC highly affected occasional users.
3 THC affected DAT (Divided Attention Task) in <u>all</u> users, both heavy users and occasional users, and especially with alcohol.

It is crucial to note that in the above studies, Dr. Ramaekers was able to <u>simultaneously</u> test impairment and THC concentration. That can easily be done in controlled laboratory settings, but is <u>impossible</u> in the world of law enforcement. As Hartman reported, "Blood collection occurs about 90 min after arrest and 3 to 4hr after an accident—long enough that many samples have become cannabinoid negative, although the
blood may have been positive at the time of the event."

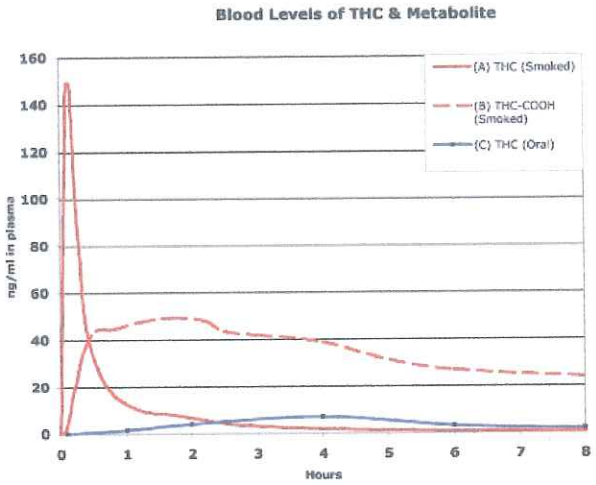
Grotenhermen [8]published the graph shown below in his 2005 publication:

---

[6] Ramaekers, J.G. et.al.; Cognition and motor control as a function of Δ^9THC concentration in serum and oral fluid: Limits of iimpairment; *Drug and Alcohol Dependence*, 85 (2006) 114-122

[7] Ramaekeres, J.G. et.al.; Tolerance and cross-tolerance to neurocognitive effects of THC and alcohol in heavy cannabis users; *Psychopharmacology* DOI 10.1007/s002130010-2042-1

[8] Grotenhermen, F., et.al.; Developing Science-Based Per Se Limits for Driving under the Influence of Cannabis (DUIC)



It shows that THC concentrations drop by over 80% within the first hour after smoking, and about 45% per hour thereafter. This is a fundamental reason why most states insist upon a zero tolerance THC level, rather than trying to define a level for impairment. By the time the blood is drawn to test the THC concentration, it longer represents the THC level at the time of arrest.

In contrast, alcohol metabolizes in a linear fashion at between .015 and .020 gm/dl-hr. Since the metabolism rate is linear, it is possible to extrapolate back from a single data point to estimate the alcohol concentration at the time of the precipitating incident. That's impossible with THC's first order kinetic metabolism.

In 2005 Grotenhermen[9] published "Developing Science-Based Per Se Limits for Driving under the Influence of Cannabis (DUIC)," copy attached. This was an expert panel that included Jan Ramaekers. Highlights include:

1 There are three phases of a cannabis "high":
   a. Acute – 0 – 60 minutes
   b. Post acute – 60-150 minutes
   c. Residual – 2 ½ - 5 hours

   The duration of each phase is dose dependant.
2 There is no unambiguous relationship between "high" and THC concentration in the acute phase
3 Earlier studies from the 1990s showed low odds ratio for traffic crash statistics, likely due to low THC in cannabis at that time. Studies beginning in 2000 show high odds ratio if the THC concentration exceeds 2 ng/ml in blood.
4 Alcohol and marijuana impairment manifest themselves differently:

	THC	Alcohol
Speed	slower	faster
Lane control	worse	worse
Risk taking	lower	higher
Self confidence	lower	higher

5 Grotenhermen quoted Berghaus analysis as:
   a. 30%+ impaired at 1-2 ng/ml in blood
   b. 45% impaired at 3-4 ng/ml in blood
   c. 58% impaired at 4-5 ng/ml in blood
6 Most acute effects subside in 3-4 hours, longer if the dose is high.
7 The panel chose impairment *per se* limits of 3.5 – 5 ng/ml in blood

[9] Grotenhermen, *ibid*

Two years later, Grotenhermen[10] published "Developing limits for driving under cannabis," putting much of his previous work into a peer-reviewed paper. This work described more clearly, the assumptions used in the prior paper, and confirmed in this paper:

1 BAC of .04 reduces driving skills by 30%. So does 2-2.5 ng/ml THC in blood (4-5 ng in serum).
2 In Germany, .04 BAC was determined to define alcohol impairment, but the level was raised to .05 for safety margin due to analytical variances. Hence Germany's .05 limit for alcohol *per se.*
3 Using the same logic, Grotenhermen assumed that analytical errors in measuring THC concentration were much higher, so he added 3.4 ng/ml analytical error to the average 4.2 ng/ml impairment assessment, yielding 7.6 ng/ml. He rounded that up to 7-10 ng/ml in serum, resulting in a 3.5 – 5 ng/ml recommendation in blood.

Empirical data

The National Highway Traffic Safety Administration (NHTSA) developed and manages the Fatal Accident Reporting System (FARS). Colorado participates through the Colorado Department of Transportation (CDOT). Data are collected principally from regular DOR reports of fines reported by law enforcement agencies, and surveys taken of coroners. Because of the structure of FARS and the way in which the data are collected, the reports have their limitations. Nevertheless, they are useful, particularly to show trends. Following is a summary report issued by CDOT for 2011, the latest year for which data are available:

Fatalities Involving Drivers with Positive Drug Test 2006-2011

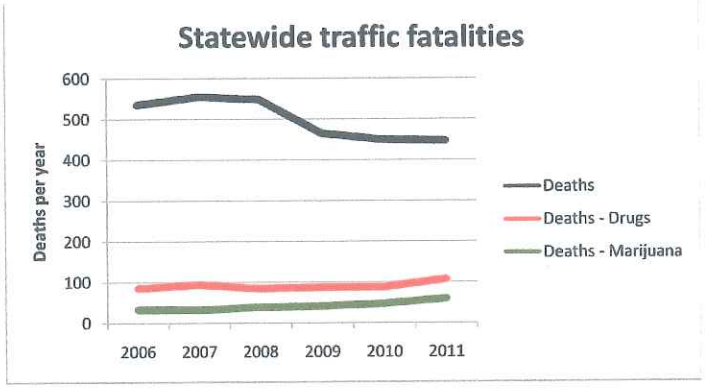
Crash Year	Fatalities by Driver with positive Drugs	Fatalities by Driver with positive Cannabis	Fatalities by Drivers with Reported Drug Results	Percentage of Fatalities Involving Drugs over the number of Fatalities with Drug Reports from Drivers	Percentage of Fatalities Involving Cannabis over the number of Fatalities with Drug Reports from Drivers
2006	85	33	273	31.14%	12.09%
2007	94	32	318	29.56%	10.06%
2008	84	39	358	23.46%	10.89%
2009	88	41	278	31.65%	14.75%
2010	88	47	276	31.88%	17.03%
2011	107	59	305	35.08%	19.34%

Drivers with Positive Drug Test Involved in Fatal Crashes 2006-2011

Crash Year	Drivers of Fatal Crashes of positive Drug Tests	Drivers of Fatal Crashes of positive for Cannabis	Drivers involved in Fatal Crashes with Reported Drug Results	Percentage of Drivers with positive drugs over Driver with drug results	Percentage of Drivers positive for Cannabis over Driver with drug results
2006	75	27	245	30.61%	11.02%
2007	81	26	281	28.83%	9.25%
2008	72	31	280	25.71%	11.07%
2009	82	37	254	32.28%	14.57%
2010	79	42	250	31.60%	16.80%
2011	93	52	257	36.19%	20.23%

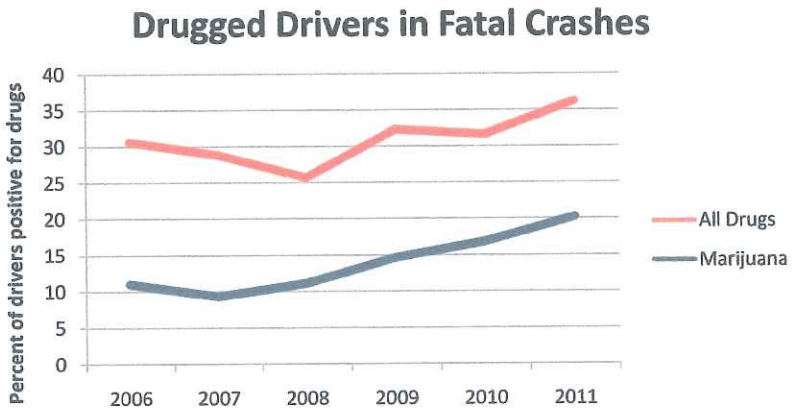
[10] Grotenhermen, F. et.al.; Developing limits for driving under cannabis; *Addiction* V 102, pp 1910-1917

The bad news is that drugged driving, led by marijuana continues its inexorable increase. Fatalities by drivers with positive drugs (all drugs) increased 22% and fatalities by drivers with positive marijuana increased 26%!



The above graph understates the problem of drugged driving because complete data on drug content are not provided to CDOT. Drug data are available from 85% of deceased drivers, but only 15% of surviving drivers.

The alarming trends of marijuana-impaired driving become more apparent when we look at the percentage trends:



Marijuana impairment once constituted 1/3 of all drug impairment in fatal crashes. In 2010, the year marijuana dispensaries were legalized, marijuana crossed the 50% mark, and was 56 % of the problem of drugged driving in 2011.

Additional data released (along with editorial comments) include:

1. 51% of drivers involved with fatal collisions who test positive for impairing substances test positive for drugs. The remaining 49% test positive for either alcohol or a combination of alcohol of drugs. This indicates that drugged driving is no longer a fringe problem in Colorado, it's a major, mainstream problem that we must deal with.
2. Colorado tests 85% of deceased drivers for drugs, but only 16% of surviving drivers. To fully understand our drugged driving problem and our progress in dealing with this problem, it is essential to mandate drug testing for all drivers involved in collisions that result in either death or injury sufficiently serious that someone must be transported to a hospital.

3 Colorado kills an average of 2 people per week with drivers who test positive for drugs. This is a greater annual death toll than the combined death toll of the shootings at Columbine and Aurora Theater – by a factor of four.
4 36% of drivers involved in fatal collision test positive for drugs.
5 20% of drivers involved in fatal collisions test positive for marijuana. This percentage has more than doubled since 2007.
6 Drivers testing positive for drugs continue to increase at the same time that traffic deaths continue to decrease. The rate of drug implicated driving, especially marijuana, rose dramatically after the Ogden memo in 2009 and again after legalizing marijuana dispensaries in 2010.

Expert Panel Review

In 2011,CCJJ's Drug Policy Task Force (DPTF) convened a panel to provide guidance in selecting a THC *per se* limit for Colorado. Two documents attached memorialize that panel. The first is the official minutes published to CCJJ, and the second is a letter from Dr. Huestis of NIDA to Sarah Urfer. Dr. Huestis was unable to testify in person, so she provided a letter. If you choose to download a copy of the CCJJ memo from the internet, be sure to download the copy from the state, not from the marijuana lobby, since their copy was edited to remove comments unfriendly to the marijuana community.

It is clear from the record that the DPTF recommended a 5 ng/ml THC limit in spite of the Expert Panel, not because of it. Following are key excerpts from the minutes:

> Dr Carl Hart, Associate Professor of Psychology at Columbia University, renowned researcher on psychopharmacology and drugs of abuse. Dr Hart has publicly advocated legalization of marijuana. He told the DPTF, "My peer toxicologists across the US believe 5 ng/ml THC is too high for *per se* limit."
>
> Dr Marilyn Huestis, Chief of Chemistry and Drug Metabolism at NIDA, the National Institute of Drug Abuse. She told the DPTF, "Many advocate for zero tolerance limit; a limit of 5 ng/ml is whole blood is most likely too high..."
>
> Cindy Burbach, Forensic Toxicologist at the Colorado Department of Public Health and Environment said, "Five ng is a very high level and you'll miss a lot of people." She further recommended one or two ng or zero tolerance.

The most interesting exchange is from Dr. Huestis' letter to Sarah Urfer:

> Q A number of states have adopted per se DUID legislation for DUID THC. You have mentioned in some of your research the levels of THC in whole blood and plasma that the toxicology community is recommending for DUID THC per se. My understanding is that these recommendations range from zero tolerance up to 5 ng/ml in whole blood as the DUID per se level. Do you agree with this assessment based on your own research?
> A No, to my knowledge the range recommended is from zero tolerance up to 2 ng/ml THC in whole blood. Whole blood concentrations are about 0.4 to 0.6 those of plasma or serum concentrations. Dr. Ramaekers recommended serum THC concentrations of 2-5 ng/ml as cognitive impairment was documented in the majority of individuals at these levels; this would be equivalent to about 1 to 2.5 ng/ml in whole blood.

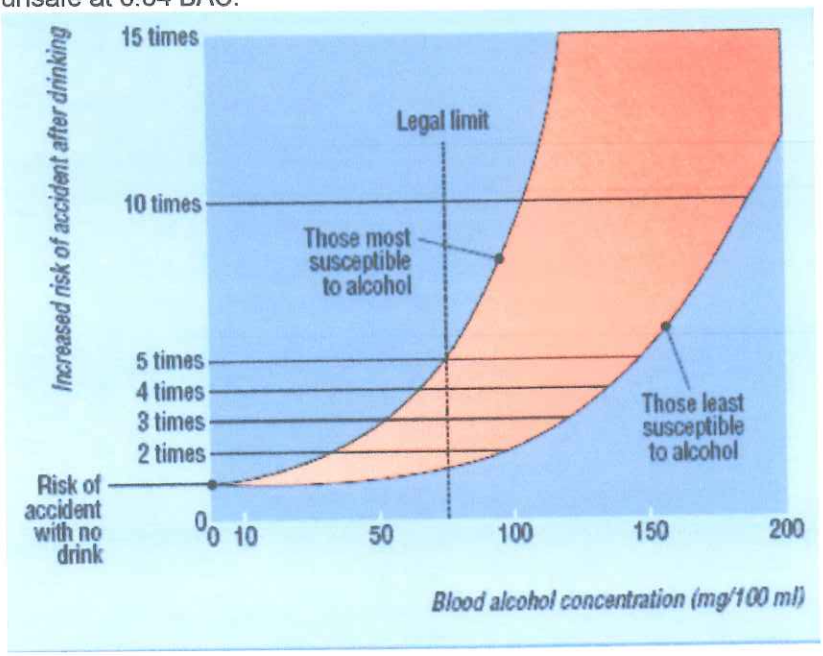
The above exchange suggests that 5 ng/ml was being considered by the DPTF even before the Expert Panel was convened.

Key Issues

As we look at alcohol *per se* laws compared with THC *per se* laws, there are two important issues we must keep in mind:

1 Individual tolerances to cannabis vary much more widely than they do for alcohol.
2 THC's metabolic rate is both non-linear and much more rapid than alcohol.

Individuals vary in their sensitivity to alcohol. Some can drive safely above BAC .08, others are unsafe at 0.04 BAC.[11]



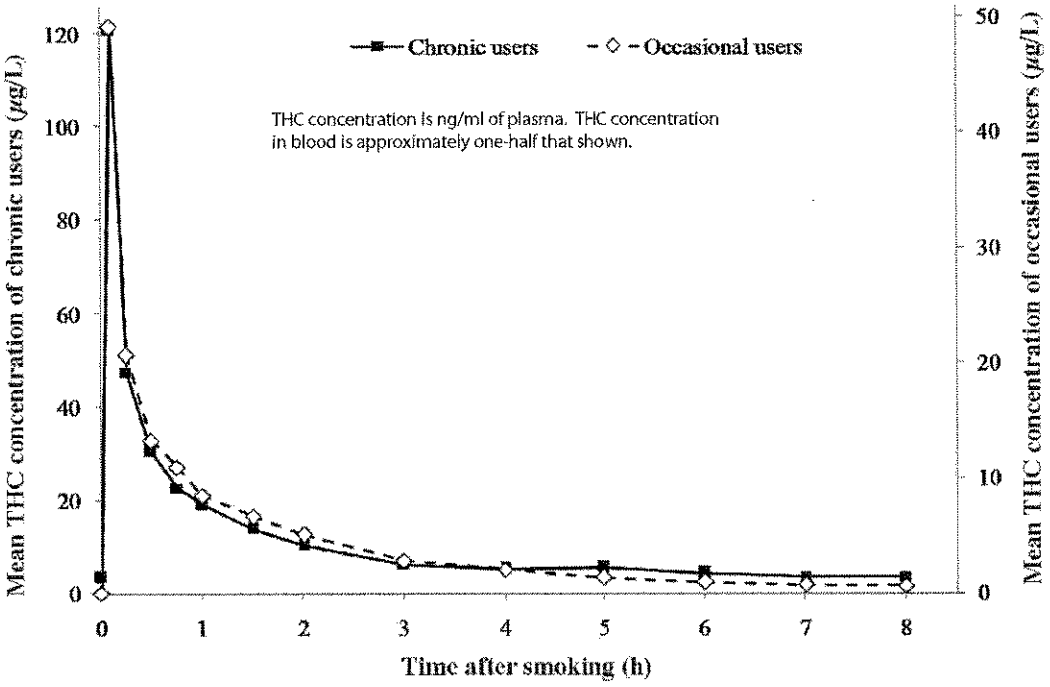
Sensitivities to alcohol vary by about 2:1. Sensitivities to drugs vary much more than alcohol. Sensitivities to synthetic opioids vary by as much as 100:1. This is one reason for our current epidemic of prescription opioid overdoses. THC sensitivities are estimated to be 10:1, perhaps more.

The first alcohol *per se* laws were set at .15 BAC. Drunk driving deaths did not begin their decline until the *per se* limits were set at .08 in the interests of public safety, instead of in the interests of tolerant alcoholics. Of course, alcoholics do not engender the same level of sympathy that Colorado extends to chronic users of marijuana.

The second issue of THC's metabolism was described above, when we showed the metabolism chart published by Grotenhermen. This study was repeated using more potent marijuana[12], testing the metabolic differences between occasional users and daily users. Their metabolism rates were identical, as shown on the chart below. Daily users start and end at a different level, but their metabolism curve is identical.

[11] Paton, A; "Alcohol In The Body; *British Medical Journal*, V 330, pp85-87

[12] Tonnes, S. et.al.; "Comparison of Cannabinoid Pharmocokinetic Properties in Occasional and Heavy Users Smoking a Marijuana or Placebo Joint"; *Journal of Analytical Toxicology*, Vol 32, Sept 2008, pp470-477



This once again demonstrates that THC concentration levels in blood drop over 80% within the first hour after smoking, and about 45% per hour thereafter.

Taken together, these two issues will lead to the following frequent occurrences with any THC *per se* level:

1. There will be drivers who are able to drive safely whose blood level of THC is above whatever the *per se* limit happens to be (unless that level is set to absurdly high limits).
2. There will be drivers who are unsafe to drive, whose THC blood level will be below the *per se* limit (unless that level is set to zero).

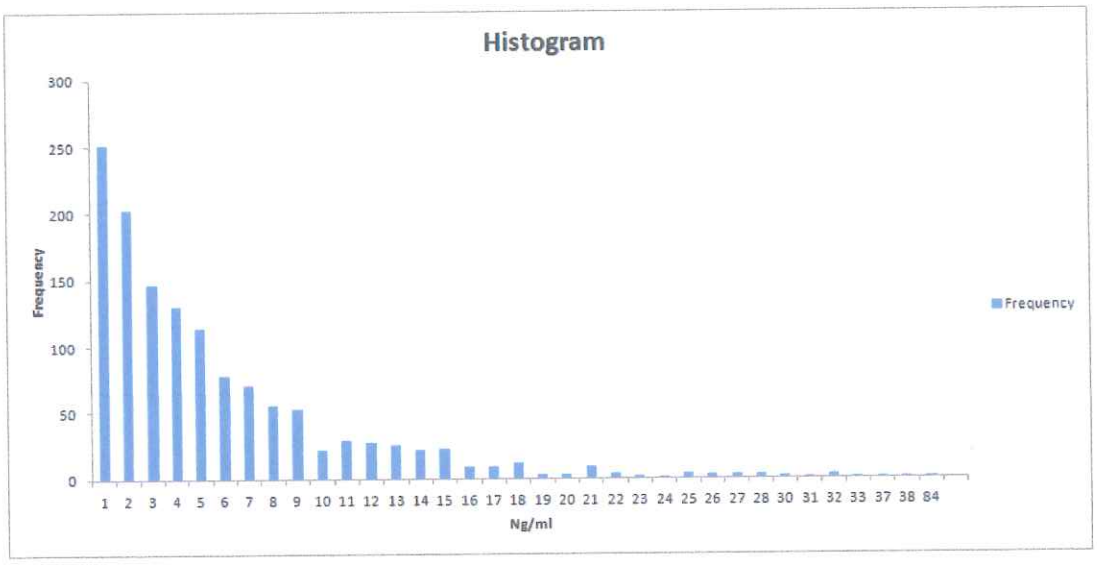
The same events occur with alcohol *per se* limits.

1. Some drivers will be able to drive safely with a BAC .08 or above.
2. Some drivers who are judged unsafe to drive by arresting officers have an alcohol blood level below the legal limit.

In statistics, these are referred to as Type 1 errors (a false positive) and Type 2 errors (a false negative), respectively. It's useful to consider statistical terms in this argument, since *per se* laws apply a yes/no decision to a large population . The rational objective then becomes one of selecting the *per se* limit to maximize the net benefit to society. It also is important to establish other protections to ensure *per se* limits are not used for unjustified entrapment of those who are innocent. Our requirement for probable cause to request a blood sample does that. The use of a permissible inference, instead of a strict *per se* determination is another way to do that.

A histogram is one effective tool to establish what the permissible limit should be. A histogram is simply a bar chart showing the frequency of finding specific blood THC levels in suspects that have been arrested because there is sufficient probable cause for the arresting officer to believe that the suspect was driving under the influence of something such as a drug or marijuana.

The following histogram is from CDPHE 2012 data:



Not shown on the histogram were those samples that tested below 1 ng/ml, CDPHEs Limit of Quantitation, and those samples where the quantity of blood was insufficient to perform a confirmatory test.

Historically, CDPHE has reported that it is normal for over 70% of THC positive blood samples to test below 5 ng/ml. Remember, 100% of these blood samples were taken from drivers who presented probable cause for driving under the influence:

	2009	2010	2011	2012
THC Positive	791	1,635	2,030	2,099
5 ng and higher	222	474	574	595
% below 5 ng	72%	71%	72%	72%

Included in the 2010 data is Steven Ryan, who killed Tanya and Adrian Guevarra while he was admittedly stoned on marijuana. He tested at 4 ng/ml of THC. He is now in prison, convicted of a Class 3 felony. He would most likely have been convicted of a Class 4 felony under a 5 ng law, and subject to a sentencing guideline one-half that of a Class 3 felony.

So what do we know about the number of arrestees who test below Colorado's two alcohol standards? Data from Colorado are lacking, but two studies done by Stephen Talpins, JD provide an insight:

Source	Sample size	<.08 BAC	<.05 BAC
Miami Dade County	25,000	11.5%	5%
Nebraska	1,499	21.1%	5%

How effective would our alcohol *per se* laws be if over 70% of drivers arrested on suspicion of DUI or DWAI were found to test below the legal limit?

Experience from other states

States	Drugged Driving Law
Arizona, Georgia, Utah	Zero Tolerance, all controlled substances and their metabolites, taken illegally
Illinois, Iowa, Rhode Island, California (SB13-289)	Zero Tolerance, all controlled substances.

	All but Rhode Island restrict illegal use only.
North Carolina, South Dakota	Zero Tolerance, all controlled substances and their metabolites in minors. NC permits medical use.
Delaware, Indiana, Pennsylvania, Wisconsin,	Zero Tolerance, Schedule I, and some or all of schedule II or III drugs taken illegally
Michigan	Zero Tolerance, Schedule I
Minnesota	Zero Tolerance, Schedule I except marijuana or II taken illegally,
Nevada, Ohio	Defined levels of several drugs, including marijuana, at 2 ng/ml THC
Virginia	Defined levels of several drugs, THC not included
Washington	5 ng/ml THC permissible limit, except zero THC permitted in minors
Colorado (HB13-1114)	**5 ng THC permissible limit**

No state, other than Washington, has a permissible limit as high as 5 ng/ml. And that standard was written by the committee to legalize marijuana in that state! But they had the common sense to include a zero tolerance for THC in minor drivers.

Colorado's proposed bill is by far the weakest DUID bill in the nation. To weaken it even further, the bill removes Colorado's current prohibition on driving by habitual users of controlled substances, presumably because this clause has never been enforced in Colorado. For reference, it's useful to realize that the only European country that condones use of cannabis, The Netherlands, considers daily users of cannabis to be unfit to drive, and their licenses are revoked.

To make Colorado's proposed bill even weaker, officers are prevented from using knowledge about a driver's medical marijuana status to establish probable cause to make an arrest. This, in spite of the fact that knowing that a driver is a likely daily user of cannabis should alert the officer that standard field sobriety tests would be inadequate to confirm impairment, and that a DRE should be called in to make an assessment.

Summary of Hard Science Analysis

Reisfield[13] and colleagues probably stated it best, "Thus, for more than a quarter century, there has been a search for drug blood concentrations that are the equivalent of the 0.08 gm/dL threshold for alcohol-impaired driving in the United States. We suggest that such equivalents are a mirage, and cannot be determined due to variable drug tolerance, lack of consistent relationships between drug blood concentrations and impairment, innumerable drug combinations and multiple other factors. Thus, while the idea of determining impairing drug concentrations is attractive, it is ultimately unattainable, and withholding drugged driving legislation pending the acquisition of such data is tantamount to a plan for inaction with regard to an important and growing public health and safety problem."

Nevertheless, research continues. One of the most compelling recent studies[14] published three months ago demonstrates that daily cannabis users remain impaired long after their blood levels drop below 1 ng/ml.

[13] Reisfield, G.M., et.al.; The Mirage of Impairing Drug Concentration Thresholds; *Journal of Analytical Toxicology* 2012: Vol 36 pp 353-356

[14] Bosker, W.M., et.al.; Psychomotor Function in Chronic Daily Cannabis Smokers during Sustained Abstinence; *PLOS ONE*, January 2013, Vol 8, Issue 1, e53127

SAMHSA reports that Colorado is one of the top five states in the country using marijuana. No surprise there. It's also in the top five states in use of illicit drugs other than marijuana. It's one three states where perceptions of risk for use of marijuana has declined significantly for those ages 12 and older.

With Amendment 64's approval, we are about to unleash an unprecedented wave of impaired driving that puts all Coloradans at risk.

We urge legislators to act responsibly in the interests of the public, not in the interests of the marijuana lobby. Amend HB 1114 as suggested on page one before passing it. Then charge CCJJ or a similar entity to bring forth legislation next year that can address this problem in a fundamental manner, as proposed by DuPont[15].

[15] DuPont, R.L., et.al.; The Need for Drugged Driving *Per Se* Laws: A Commentary; *Traffic Injury Prevention*, 13:31-42, 2012